AMENDMENTS TO THE CLAIMS

1.   (Currently Amended) A telecommunications transmission system having at least two VDSL systems, each comprising a pair of modems, said at least two VDSL systems belonging to a binder group common to the at least two VDSL systems, wherein

- a transmitter in a first modem in the pair of modems including:

  - a extension means (P/S) for cyclic extension of a DMT-symbol by way of adding a prefix or a suffix, and

  - a pulse shaper means, adapted to pulse shape sidelobes of a cyclic extended DMT-symbol;

wherein said cyclic extension further comprises:

  - a suffix which is greater than, or equal to, a channel's propagation delay; and

  - a prefix which is greater than, or equal to, a guard time needed to eliminate inter-symbol interference.

2.   (Currently Amended) A telecommunications system, as claimed in claim 1, wherein said ~~at least two~~ pair of modems are Zippermodems.

3.   (Canceled)

4.   (Currently Amended) A telecommunications system, as claimed in claim 1, wherein said pulse shaped ~~wings~~ sidelobes are in the form of a raised cosine pulse.

5.   (Previously Presented) A telecommunications system, as claimed in claim 1, wherein the same number of sub-carriers are used for transmission in an up stream direction as are used for transmission in a down stream direction.

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6.   (Previously Presented)   A telecommunications system, as claimed in claim 1, wherein a different number of sub-carriers are used for transmission in an up stream and a down stream directions.

7.   (Previously Presented)   A telecommunications system, as claimed in claim 1, wherein said transmitter comprises a b-bit buffer and encoder for receiving an input bit stream at a rate of R bit/s, an n-point IDFT processor for receiving an output from said b-bit buffer and encoder, extension means for adding a cyclic extension to an output of said IDFT processor, a pulse shaper for shaping a DMT symbol output from said extension means, and a digital to analog converter and low pass filter for converting a DMT symbol received from said pulse shaper to analog form and passing said DMT to a transmission channel.

8.   (Currently Amended) A telecommunications system, as claimed in claim 1, ~~wherein said~~ comprising a receiver that includes an analog to digital converter for digitizing a DMT symbol received from a transmission channel, a windowing unit connected to an output of said analog to digital converter, a stripper unit for removing cyclic extensions to said DMT symbol, an n-point DFT processor for receiving an output from said stripper unit, a frequency domain equalization unit for receiving an output from said n-point DFT unit and decoder, and a b-bit buffer for receiving an output from said frequency domain equalization unit and outputting a bit stream at R bit/s.

9.   (Currently Amended) A modem for use in a transmission system ~~as claimed in claim 1~~, wherein said modem includes a transmitter as claimed in claim 7.

10.   (Currently Amended)   A modem ~~as claimed in claim 9~~ for use in a transmission system, wherein said modem includes a receiver as claimed in claim 8.

11.   (Previously Presented) A method in a telecommunication system having at least two VDSL systems adapted to asynchronously transmit DMT-symbols between modems; each of the at

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least two VDSL systems comprising a pair of modems, said at least two VDSL systems belonging
to a binder group common to both VDSL systems, comprising the steps of:

- in a transmitter in a first modem in a pair of modems
- cyclic extend a DMT-symbol by way of adding a prefix and a suffix;
- pulse shaping side lobes of the cyclic extended DMT-symbol;
- transmit the cyclic extended and pulse shaped DMT-symbol to a transmission channel;
- and in a receiver in a second modem in the pair of modems
- windowing the DMT-symbol which transmits on the transmission channel by way of multiplying a first number of samples at the beginning and end of a block of 2N plus the first number of samples, wherein 2N defines a second number of a samples in the DMT symbol; folding and adding the first number of samples divided by two from the beginning of the block to the end of the 2N remaining samples; and folding and adding the first number of samples divided by two from the end of the block to the beginning of the 2N remaining samples, and removing said cyclic extension from a DMT-symbol.

12.   (Previously Presented) A method, as claimed in claim 11 further comprising adding a cyclic extension to DMT symbols, said cyclic extension comprising:

- a suffix which is greater than, or equal to, a channel's propagation delay; and
- a prefix which is greater than, or equal to, a guard time needed to eliminate inter-symbol interference.

13.   (Previously Presented) A method as claimed in claim 11, further comprising forming said pulse shaped wings as a raised cosine pulse.

14.   (Previously Presented)   A method as claimed in claim 11, further comprising performing said pulse shaping at a transmitter after addition of a cyclic extension to a symbol and prior to digital to analog conversion.

15.   (Previously Presented)   A method as claimed in claim 11, further comprising transmitting the same number of sub-carriers in both an upstream and a down stream direction.

16.   (Previously Presented)   A method as claimed in claim 11, further comprising transmitting a different number of sub-carriers in an up stream and a down stream direction.

17.   (Previously Presented)   In a frequency division duplex communication system having a plurality of transmission channels, each transmission channel of the plurality of transmission channels having a plurality of discrete carrier frequencies, a method for processing a frequency domain symbol having a plurality of frequency components, the method comprising:

a) deriving a time domain symbol from the plurality of frequency components of the frequency domain symbol;

b) prior to transmission of the time domain symbol, reducing the frequency content of the time domain symbol so as not to interfere with other symbols on other transmission channels by pulse shaping the time domain symbol to form pulse-shaped wings on the time domain symbol in order to reduce crosstalk in other transmission channels of the plurality of transmission channels;

c) transmitting the time domain symbol on the one of the plurality of transmission channels; and

d) after transmission of the time domain symbol, further reducing the frequency content of the time domain symbol so as not to interfere with the other symbols on the other transmission channels by applying a windowing function to the time domain symbol.

18.   (Previously Presented) The method of claim 17, further comprising adding at least one cyclic extension to the time domain symbol before pulse shaping the time domain symbol.

19.   (Previously Presented) The method of claim 18, wherein adding at least one cyclic extension to the time domain symbol further comprises adding at least one of a cyclic prefix and a cyclic suffix to the time domain symbol.

20.   (Previously Presented)   The method of claim 18, wherein reducing the frequency content of the time domain symbol further comprises pulse shaping the at least one cyclic extension of the time domain symbol.

21.   (Previously Presented)   The method of claim 18, wherein reducing the frequency content of the time domain symbol further comprises pulse shaping the time domain symbol using a raised cosine pulse.

22.   (Previously Presented)   The method of claim 19, wherein the act of adding at least one of a cyclic prefix and a cyclic suffix to the time domain symbol further comprises adding at least one of a cyclic prefix and cyclic suffix to the time domain symbol, the cyclic prefix having a length greater than or equal to a guard time needed to eliminate inter-symbol interference and the cyclic suffix having a length greater than or equal to a propagation delay of the transmission channel.

23.   (Previously Presented)   The method of claim 18, wherein the act of further reducing the frequency content of the time domain symbol further comprises:

multiplying a first number of samples at the beginning and end of a block of 2N plus the first number of samples of the time domain symbol wherein a2N defines a second number of samples in the time domain symbol;

folding and adding the first number of samples divided by two from the beginning of the block to the end of the remaining 2N samples of the time domain symbol; and

folding and adding the first number samples divided by two from the end of the block to the beginning of the remaining 2N samples of the time domain symbol.

24.   (Previously Presented)   In a frequency division duplex communication system having a transmission channel, the transmission channel having a plurality of discrete carrier frequencies, an apparatus for transmitting a frequency domain symbol having a plurality of frequency components, the apparatus comprising:

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a) a processor having an input and an output that receives the frequency domain symbol at the input of the processor and generates, based on the plurality of frequency components of the frequency domain symbol, a first time domain symbol at the output of the processor;

b) a pulse shaper having an input and an output that, prior to transmission of the first time domain symbol, receives at the input of the pulse shaper the first time domain symbol and shapes the first time domain symbol to form pulse-shaped wings on the first time domain symbol so as not to interfere with other symbols on other transmission channels in order to generate a second time domain symbol at the output of the pulse shaper;

c) a transmitter having an input and an output that receives the second time domain symbol at the input of the transmitter in order to transmit the second time domain symbol over the transmission channel at the output of the transmitter; and

d) a windowing element having an input and an output that, after transmission of the second time domain symbol receives the second time domain symbol at the input of the windowing element and applies a windowing function to the second symbol so as not to interfere with other symbols on other transmission channels in order to generate a third time domain symbol at the output of the windowing element.

25.   (Previously Presented) The apparatus of claim 24, further comprising means for adding at least one cyclic extension to the time domain symbol before pulse shaping the time domain symbol.

26.   (Previously Presented) The apparatus of claim 25, wherein the means for adding at least one cyclic extension to the time domain symbol further comprises means for adding at least one of a cyclic prefix and a cyclic suffix to the time domain symbol.

27.   (Previously Presented) The apparatus of claim 25, wherein the pulse shaper further comprises means for pulse shaping the cyclic extensions of the time domain symbol.

28.   (Previously Presented) The apparatus of claim 25, wherein the pulse shaper further comprises means for pulse shaping the first DMT symbol using a raised cosine pulse.

29.   (Previously Presented) The apparatus of claim 26, wherein the cyclic prefix has a length greater than or equal to a guard time needed to eliminate inter-symbol interference and the cyclic suffix has a length greater than or equal to a propagation delay of the transmission channel.

30.   (Previously Presented) The apparatus of claim 25, wherein the windowing element further comprises:

means for multiplying a first number of samples at the beginning and end of a block of $2N$ plus the first number of samples of the time domain symbol wherein $2N$ defines a second number of samples in the time domain symbol;

means for folding and adding the first number of samples divided by two from the beginning of the block to the end of the remaining $2N$ samples of the time domain symbol; and

means for folding and adding the first number of samples divided by two from the end of the block to the beginning of the remaining $2N$ samples of the time domain symbol.

31.   (Previously Presented) In a frequency division duplex communication system having a transmission channel, the transmission channel having a plurality of discrete carrier frequencies, an apparatus of processing a frequency domain symbol having a plurality of frequency components, the apparatus comprising:

a) means for deriving a time domain symbol from the plurality of frequency components of the frequency domain symbol;

b) prior to transmission of the time domain symbol, means for reducing the frequency content of the time domain symbol so as not to interfere with other symbols on other transmission channels by pulse shaping the time domain symbol to form pulse-shaped wings on the time domain symbol;

c) means for transmitting the time domain symbol on the one of the plurality of transmission channels; and

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d) after transmission of the time domain symbol, means for further reducing the frequency content of the time domain symbol so as not to interfere with the other symbols on the other transmission channels by applying a windowing function to the time domain symbol.

32.   (Previously Presented)   In a frequency division duplex communication system having a transmission channel, the transmission channel having a plurality of discrete carrier frequencies, and a pair of modems, the pair of modems including a first modem located at a first end of the transmission channel and a second modem located at a second end of the transmission channel, a method for transmitting a frequency domain symbol having a plurality of frequency components, the method comprising:

a) deriving a time domain symbol from the plurality of frequency components of the frequency domain symbol;

b) reducing the frequency content of the time domain symbol by pulse shaping the time domain symbol to form pulse-shaped wings on the time domain symbol so as not to interfere with other symbols on other transmission channels prior to transmission of the time domain symbol;

c) using the first modem to transmit the time domain symbol on one of the plurality of carrier frequencies of the transmission channel;

d) using the second modem to receive the time domain symbol on the one of the plurality of carrier frequencies of the transmission channel; and

e) after receipt of the time domain symbol further reducing the frequency content of the time domain symbol by applying a windowing function to the time domain symbol so as not to interfere with the other symbols on the other transmission channels.

33.   (Currently Amended)   A telecommunications transmission system having at least two VDSL systems, each comprising a pair of modems, said at least two VDSL systems belonging to a binder group common to the at least two VDSL systems, wherein

-           a transmitter in a first modem in the pair of modems including:

-           a extension means (P/S) for cyclic extension of a DMT-symbol by way of adding a prefix or a suffix, and

-        a pulse shaper means, adapted to pulse shape sidelobes of a cyclic extended
        DMT-symbol;

        wherein said cyclic extension further comprises:

-        a suffix which is greater than, or equal to, a channel's propagation delay; and

-        a prefix which is greater than, or equal to, a guard time needed to eliminate inter-symbol

interference;

~~A telecommunications transmission system as claimed in claim 1,~~ wherein a receiver in a

second modem in the pair of modems ~~including~~ includes:

-windowing means adapted to multiplying a first number of samples at the beginning and

end of a block of 2N plus the first number of samples of the DMT symbol, 2N being the

number of a samples of a non cyclic extended DMT symbol; folding and adding the first

number of samples divided by two from the beginning of the block to the end of the 2N

remaining samples; and folding and adding the first number of samples divided by two from

the end of the block to the beginning of the 2N remaining samples,

-a stripping means (s/p) for removing said cyclic extension from a DMT-symbol.

34.   (Previously Presented) A modem in a telecommunications system, comprising:

a receiver adapted to receive from a transmission channel a discrete multitone (DMT)

symbol that includes a cyclic extension;

windowing means adapted to multiply a first number of samples at the beginning and end of

a block of 2N plus the first number of samples of the DMT symbol, wherein 2N is defined as

the number of a samples in a non-cyclic extended DMT symbol; folding and adding the first

number of samples divided by two from the beginning of the block to the end of the 2N

remaining samples; and folding and adding the first number of samples divided by two from

the end of the block to the beginning of the 2N remaining samples; and

stripping means adapted to remove the cyclic extension from the DMT symbol.

35.   (Previously Presented)   The modem of claim 34, wherein the cyclic extension

includes:

a suffix which is greater than, or equal to, a propagation delay of the transmission channel;

and

a prefix which is greater than, or equal to, a guard time needed to eliminate inter-symbol

interference.

36.   (Previously Presented) The modem of claim 35, further comprising:

an analog to digital converter for digitizing the DMT symbol;

an n-point DFT processor for receiving an output from the stripper means;

a frequency domain equalization unit for receiving an output from said n-point DFT unit and

decoder; and

a b-bit buffer for receiving an output from said frequency domain equalization unit and

outputting a bit stream at R bit/s.

37.   (Previously Presented) The modem of claim 34, wherein the transmission channel

includes a same number of sub-carriers for transmission in an up stream direction as sub-carriers for

transmission in a down stream direction.

38.   (Previously Presented) The modem of claim 34, wherein the transmission channel

includes a different number of sub-carriers for transmission in an up stream than sub-carriers for

transmission in a down stream direction.

39.   (New) A telecommunications system, as claimed in claim 33, wherein said pair of

modems are Zippermodems.

40.   (New) A telecommunications system as claimed in claim 33, wherein said cyclic

extension further comprises:

-       a suffix which is greater than, or equal to, a channel's propagation delay; and

a prefix which is greater than, or equal to, a guard time needed to eliminate inter-symbol

interference.

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41.   (New) A telecommunications system, as claimed in claim 33, wherein said pulse shaped sidelobes are in the form of a raised cosine pulse.

42.   (New) A telecommunications system, as claimed in claim 33, wherein the same number of sub-carriers are used for transmission in an up stream direction as are used for transmission in a down stream direction.

43.   (New) A telecommunications system, as claimed in claim 33, wherein a different number of sub-carriers are used for transmission in an up stream and a down stream directions.

44.   (New) A telecommunications system, as claimed in claim 33, wherein said transmitter comprises a b-bit buffer and encoder for receiving an input bit stream at a rate of R bit/s, an n-point IDFT processor for receiving an output from said b-bit buffer and encoder, extension means for adding a cyclic extension to an output of said IDFT processor, a pulse shaper for shaping a DMT symbol output from said extension means, and a digital to analog converter and low pass filter for converting a DMT symbol received from said pulse shaper to analog form and passing said DMT to a transmission channel.

45.   (New) A telecommunications system, as claimed in claim 33, comprises a receiver that includes an analog to digital converter for digitizing a DMT symbol received from a transmission channel, a windowing unit connected to an output of said analog to digital converter, a stripper unit for removing cyclic extensions to said DMT symbol, an n-point DFT processor for receiving an output from said stripper unit, a frequency domain equalization unit for receiving an output from said n-point DFT unit and decoder, and a b-bit buffer for receiving an output from said frequency domain equalization unit and outputting a bit stream at R bit/s.

46.   (New) A modem for use in a transmission system, wherein said modem includes a transmitter as claimed in claim 44.

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47.   (New) A modem for use in a transmission system, wherein said modem includes a receiver as claimed in claim 45.